

Notes on British Tunicata.—Part II. By W. A. HERDMAN, D.Sc.,  
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(PLATES XXXIII.—XXXVI.)

DURING the Session of 1880 I laid before this Society the first part (dealing with the family Ascidiidæ) of a paper on British Tunicata, a group of animals which I had shortly before commenced to study systematically. I hoped at that time that further parts would have followed in rapid succession; but various circumstances, and chiefly my having undertaken the examination of the large 'Challenger' collection, prevented me from finishing any other families of the British forms; and it is only now, after the lapse of thirteen years, that I have a further instalment of notes ready. This part falls naturally into two sections:—(1) Some corrections of my former paper, and my views as to some other British species of Ascidiacea described long ago by Forbes, Alder and Hancock, and others; and (2) my notes on some of the British Cynthiidæ.

#### I. ASCIDIIDÆ (Supplementary\*).

With the fuller knowledge I now have of variation in the Tunicata, and after the experience of the last thirteen years in examining specimens of the genus *Ascidia*, I am inclined to think that I laid too much stress upon minute structural characters in Part I., and described as new species several forms which it would be better to regard as varieties. I think that my *A. lata* may be merely the common *A. mentula*, although it differs from the usual form of that species in the small number (16 to 20) and size of the tentacles. The usual number of tentacles in *A. mentula* is about 60; but I have found only 16 in a specimen 8 cm. long, and Garstang has recorded 18; while Traustedt, on the other hand, gives 78 to 85 as the number in Mediterranean specimens.

My *A. fusiformis* may also be merely a variety of *A. mentula*; it has, however, a neater and more slender and fusiform shape, an unusually small number of stigmata in each mesh (three,

\* For former paper see Journ. Linn. Soc., Zool. vol. xv. p. 274.

while *A. mentula* has about five), while the tentacles are small and distant, 25 to 30 in number, and larger and smaller alternately. The *A. truncata* of Part I. may be a large, rough, and somewhat deformed variety of *A. aspersa*, O. F. Müller, perhaps the form described by Alder as *A. pustulosa*; my *A. triangularis*, on the other hand, is probably a small neat form of the same species (*A. aspersa*), corresponding to that described as *A. aculeata* by Alder. If one compares *A. truncata* and *A. triangularis*\* one with another, it seems almost absurd to regard them as one species; but viewed in the light of Alder's *A. pustulosa* and *A. aculeata*, and of various intermediate varieties I have found since, I have very little doubt that they are the extreme forms of a series which must be regarded as belonging to *Ascidiella aspersa*, O. F. Müller.

My *A. Patoni* may, I think, be referred to *A. venosa*. It agrees well with the species which Alder and Hancock called *venosa*, and which is usually called *venosa* now, in general appearance and in the simple condition of the branchial sac, which is quite exceptional amongst species of *Ascidia* in not being longitudinally plicated. I feel, however, somewhat doubtful whether this is really the *A. venosa* of the 'Zoologia Danica.' O. F. Müller's figure † and description show the atrial aperture as more than halfway down the body, while in the British specimens I have seen it is near the anterior end. The test also seems more flaccid and gelatinous in the northern form.

Finally, *A. exigua* of the former paper is probably the young of some other species, perhaps of *A. plebeia*; but I am not sure, as it appears to differ a little from all species known to me. I ought not to have described so small, and, as I now think, immature looking, a form as the type of a new species.

In regard to the other species referred to in Part I., I have nothing to alter; and I still hold to the relationships of the species and genera given there, except that I have since adopted the genus *Ascidiella* of Roule (1884) for those forms in which the nerve-ganglion and subneural gland are placed close to the dorsal tubercle. This genus includes the following British species: *A. venosa*, *A. virginea*, *A. aspersa*, and *A. scabra*, which can be readily distinguished as follows:—

\* See Part I., Linn. Journ. Zool. vol. xv. p. 280 *et seq.*, pls. xv. & xvi.

† Zool. Dan. tab. xxv.

- a.* Branchial sac with well-marked papillæ. *A. venosa*, O. F. M.  
*b.* No papillæ.
1. Dorsal lamina with plain margin . . . . *A. virginea*, O. F. M.
  2. Dorsal lamina with margin more or less toothed.
    - α.* Attached by small area, branchial lobes denticulated, about 5 stigmata in mesh . . . . . *A. aspersa*, O. F. M.
    - β.* Attached by whole left side, branchial lobes rounded, from 7-12 stigmata in mesh . . . . *A. scabra*, O. F. M.

I have lately gone over carefully the descriptions and figures of Ascidiæ given by O. F. Müller in the 'Zoologia Danica;' and I believe it will be useful if I give here a list of his 20 species, putting opposite each what is now considered the proper name according to my judgment. It will be noticed that his 20 species of *Ascidia* become reduced to about 16 species, referable to 9 different genera and 4 families. Nearly all these forms are British.

*List of Ascidiæ in O. F. Müller's 'Zoologia Danica.'*

ASCIDIA.	
<i>A. mentula</i>	= <i>Ascidia mentula</i> , O. F. M.
<i>A. rustica</i>	= <i>Styela rustica</i> (L.).
<i>A. venosa</i>	= ? present <i>Ascidiella venosa</i> ; or ? red soft variety of <i>A. mentula</i> .
<i>A. prunum</i>	= ? <i>Ascidiella scabra</i> (O. F. M.).
<i>A. conchilega</i>	= ? <i>Ascidia plebeia</i> ; ? <i>Polycarpa comata</i> ; or ? not British*.
<i>A. parallelogramma</i>	= <i>Corella parallelogramma</i> (O. F. M.).
<i>A. virginea</i>	= <i>Ascidiella virginea</i> (O. F. M.).
<i>A. canina</i>	= <i>Ciona canina</i> (O. F. M.), a var. of <i>C. intestinalis</i> (L.) [figs. 1-3 = <i>C. intestinalis</i> ].
<i>A. patula</i>	= ? <i>Ascidiella aspersa</i> (O. F. M.); or ? not British.
<i>A. aspersa</i>	= <i>Ascidiella aspersa</i> (O. F. M.).
<i>A. scabra</i>	= <i>Ascidiella scabra</i> (O. F. M.).
<i>A. orbicularis</i>	= ? <i>Ascidiella scabra</i> ; or ? not British.
<i>A. corrugata</i>	= <i>Ciona intestinalis</i> (L.).
<i>A. lepadiformis</i>	= <i>Clavelina lepadiformis</i> (O. F. M.).

\* It was re-described by Kupffer in 1875 as a *Phallusia* from Norwegian specimens, but is apparently not known to Traustedt.

## ASCIDIA.

- A. echinata* = *Cynthia echinata* (L.).  
*A. aggregata* = *Styela aggregata* (O. F. M.).  
*A. tubularis* = a Molgulid, possibly *Eugyra glutinans* (Möll.).  
*A. compressa* = *Ascidia compressa* (O. F. M.) [not British].  
*A. gelatina* = a *Clavelina*, probably *C. lepadiformis* (O. F. M.).  
*A. pyriformis* = *Rhabdocynthia papillosa* (L.).

Passing next to the species given by Prof. Edward Forbes in Forbes and Hanley's 'British Mollusca,' most of these are good species; but many of them have, with the progress of science, changed at least their generic names; hence the following list will probably be useful:—

In vol. i. p. 26 *et seq.*

- Clavelina lepadiformis*, O. F. M. = *C. lepadiformis* (O. F. M.).  
*Perophora Listeri*, Wieg. = *P. Listeri*, Wieg.  
*Ascidia intestinalis*, L. = *Ciona intestinalis* (L.).  
*A. canina*, O. F. M. = *Ciona intestinalis* (L.), var.  
*A. venosa*, O. F. M. = *Ascidiella venosa* (O. F. M.).  
*A. mentula*, O. F. M. = *Ascidia mentula*, O. F. M.  
*A. arachnoidea*, Fab. Requires further investigation  
 [? *Phallusia mammillata*].  
*A. scabra*, O. F. M. = *Ascidiella scabra* (O. F. M.).  
*A. virginea*, O. F. M. = *Ascidiella virginea* (O. F. M.).  
*A. parallelogramma*, O. F. M. = *Corella parallelogramma* (O. F. M.).  
*A. prunum*, O. F. M. = ? *A. scabra* (O. F. M.).  
*A. orbicularis*, O. F. M. = *A. scabra* (O. F. M.).  
*A. aspersa*, O. F. M. = *Ascidiella aspersa* (O. F. M.).  
*A. vitrea*, van Ben. = ? young of *A. virginea* (O. F. M.).  
*A. conchilega*, O. F. M. = a *Molgula*; requires further investigation.  
*A. echinata*, L. = *Cynthia echinata* (L.).  
*Molgula oculata*, Forb. = *M. oculata*, Forb.  
*M. tubulosa*, Rath. = *Eugyra glutinans* (Möll.).  
*Cynthia microcosmus*, Sav. Requires further investigation.  
*C. claudicans*, Sav. = ? *Cynthia squamulosa*, Ald.  
*C. tuberosa*, Macg. = *Polycarpa pomaria*, Sav.  
*C. quadrangularis*, Forb. = *Polycarpa quadrangularis* (F.).  
*C. informis*, Forb. = *Styela informis* (F.).



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<i>Cynthia tessellata</i> , Forb. } <i>C. limacina</i> , Forb. }	= <i>Forbesella tessellata</i> (Forb.).
<i>C. morus</i> , Forb.	= <i>C. morus</i> , Forb.
<i>C. rustica</i> , Linn.	= (?) <i>Polycarpa glomerata</i> (Ald.).
<i>C. grossularia</i> , van Ben.	= <i>Styelopsis grossularia</i> (v. Ben.).
<i>C. ampulla</i> , Brug.	= <i>Polycarpa comata</i> (Ald.).
<i>C. mammillaris</i> , Pall.	Requires further investigation.
<i>C. aggregata</i> , Rath.	= <i>Styela aggregata</i> (Rath.).
<i>Pelonaia glabra</i> , F. & G. } <i>P. corrugata</i> , F. & G. }	= <i>Pelonaia corrugata</i> , Forbes & Goodsir.

SUPPLEMENTARY\* (in vol. ii. p. 372 *et seq.*).

<i>Ascidia sordida</i> , A. & H.	= <i>Ascidiella virginea</i> (O. F. M.).
<i>A. albida</i> , A. & H.	= <i>A. scabra</i> (O. F. M.).
<i>A. depressa</i> , A. & H.	= <i>Ascidia depressa</i> (Ald.).
<i>A. elliptica</i> , A. & H.	= ? <i>A. scabra</i> (O. F. M.).
<i>A. pellucida</i> , A. & H.	Requires investigation.
<i>Molgula arenosa</i> , A. & H.	= <i>Eugyra glutinans</i> (Möll.).
<i>Cynthia coriacea</i> , A. & H.	= ? <i>Polycarpa pomaria</i> (Sav.).

In order to complete this review of the more important published lists of British Ascidiidæ, I shall now state what I know in regard to the numerous species of *Ascidia* described by Messrs. Alder and Hancock. Of these very short, in fact insufficient, descriptions without any figures were published in the 'Annals and Magazine of Natural History' by Alder in 1863, and by Alder and Hancock (after the death of the former) in 1870. Unfortunately, the detailed monograph of the British Tunicata which these investigators were known to be preparing for the Ray Society was interrupted by the death of first one and then the other of the authors; but it was understood that Albany Hancock had left a considerable amount of manuscript and drawings for the plates; and it is much to be regretted that that work, incomplete though it may have been, was not published. I do not know whether the MS. is still in existence. If so, it is strange that no one working at Ascidiæ has been allowed to see it, as it could scarcely fail to throw some light upon these species, many of which are so imperfectly known. Fortunately, Canon A. M. Norman has in his magnificent collection a number

\* This covers the species described by Alder in 1848 in Trans. Tynes. Nat. Field Club, vol. i.

of specimens of Ascidians named by Alder or Hancock; and he has most kindly allowed me to examine these, many of which are the original types. For this and for the loan of many other specimens for examination and comparison, I wish to express my hearty thanks to Canon Norman.

The following is a list, with the modern names, of the species described by Alder in 1863\* (omitting species already dealt with):—

<i>Ascidia pustulosa</i>	= <i>Ascidiella aspersa</i> (O. F. M.).
<i>Ascidia obliqua</i>	= <i>A. obliqua</i> , Ald.
<i>Ascidia rudis</i>	= ? <i>A. mentula</i> , O. F. M.
<i>Ascidia plebeia</i>	= <i>A. plebeia</i> (Ald.).
<i>Ascidia aculeata</i>	= <i>Ascidiella aspersa</i> (O. F. M.).
<i>Ascidia pulchella</i>	= <i>Ciona intestinalis</i> (L.), variety.
<i>Molgula socialis</i>	= <i>M. socialis</i> , Ald.
<i>Molgula arenosa</i>	= <i>Eugyra glutinans</i> (Möll.).
<i>Cynthia squamulosa</i>	= <i>C. squamulosa</i> , Ald.
<i>Cynthia rosea</i>	= ? <i>C. squamulosa</i> , Ald.
<i>Cynthia echinata</i>	= <i>C. echinata</i> (L.).
<i>Cynthia mammillaris</i>	= <i>Styela</i> sp. ?
<i>Cynthia sulcatula</i>	= <i>Styela</i> sp. ?
<i>Cynthia granulata</i>	= <i>Styela</i> sp. ?
<i>Cynthia comata</i>	= <i>Polycarpa comata</i> (Ald.).
<i>Cynthia glacialis</i>	= <i>Styela</i> sp. ?
<i>Cynthia opalina</i>	= ? <i>Styela</i> . [Canon Norman's specimens are a <i>Molgula</i> .]
<i>Cynthia violacea</i>	= ? a <i>Molgula</i> .
<i>Cynthia glomerata</i>	= <i>Polycarpa glomerata</i> (Ald.).
<i>Thylacium Normani</i>	= <i>T. Normani</i> , Ald.
<i>Thylacium variegatum</i>	= <i>T. variegatum</i> , Ald.
<i>Diazona hebridica</i>	= <i>Diazona violacea</i> , Sav.

Also nine species of Compound Ascidians.

I shall now deal with the new species described by Hancock in 1870 †. Some of these species were described from specimens in the collection of Canon Norman, who has, as I have stated above, very kindly allowed me lately to examine the type specimens and take notes from them. This has enabled me to come

\* Ann. & Mag. Nat. Hist. ser. 3, vol. xi. p. 153.

† *Op. cit.* ser. 4, vol. vi. p. 353, "On the Larval State of *Molgula*, &c."

to some definite conclusion in regard to several of Alder and Hancock's species. Others, from the condition of the only specimens, cannot now be satisfactorily determined or characterized.

1. *A. plana*, Hnk.—I have seen no specimen of this. From Hancock's short description I do not see how it can be distinguished from a small *A. mentula*.

2. *A. Alderi*, Hnk.—I would say the same in regard to this. The characters Hancock relied upon to distinguish these two species are liable to great individual variation.

3. *A. rubrotincta*, Hnk.—I have seen Canon Norman's type specimen of this, obtained by him between tide-marks at Guernsey in 1865. It measures 6 cm. by 3 cm., and is of elongated elliptic form, with both ends about equally rounded; the branchial aperture is anterior, and the atrial is more than halfway down the dorsal edge and does not project so much as in a typical *A. mentula*. It had been attached to a shell by the middle of the left side; but no stress can be laid upon the mode of attachment in these forms, as it is probably to a large extent accidental.

The test is cartilaginous, but flexible and not thick; vessels are readily visible. The mantle is very muscular on the right side. The branchial sac is plicated. There are very large papillæ on the bars. The meshes are elongated transversely.

The tentacles are numerous, slender, and of three sizes.

The dorsal lamina is ribbed transversely.

The dorsal tubercle is rather small, and roughly of triangular shape; the aperture is anterior, and both horns are turned in.

The alimentary canal occupies the posterior two thirds of the left side.

Hancock admitted that this is closely allied to *A. mentula*; and with the greater knowledge we now have of variation in these forms, it is, I believe, impossible to separate the two. Colour is of no importance; and the other points of difference Hancock mentions are too slight to rely upon.

I have found specimens adhering to stones and seaweeds a few feet below low-water of spring tides at East Loch Tarbert, Loch Fyne, which agree well with Hancock's description of *A. rubrotincta*, and which were associated with *A. mentula*, and were evidently the same species.

4. *A. rubicunda*, Hnk.—I have examined Canon Norman's type specimens from the Hebrides and from Strangford Lough. One

of those in the bottle seems to me to be *Ascidella venosa*; the others I cannot distinguish from *Ascidia mentula*. Hancock gives as a character separating this form from *A. mentula* that it is more extensively attached, "adhering by the whole side;" but one at least of the type specimens is only slightly attached by the posterior end. The fact is that amongst specimens which I have collected at East Loch Tarbert, and which I at once referred to Hancock's "*rubicunda*," it is easy to find individuals in all conditions of attachment—some are merely clinging slightly by some one point to the edge of a stone or a *Laminaria* "root," or a piece of broken crockery, others lie flat along, and are attached by the whole surface, or, if in a crevice, even by both surfaces. I need not go over in detail the notes I have taken from Canon Norman's specimens and from my own Tarbert ones. They show a general agreement with *A. mentula* along with considerable individual variation. (See also below, p. 442.)

5. *A. robusta*, Hnk.—I have examined Canon Norman's type specimens of this from Herm; but unfortunately some of them are merely empty tests, and the others are in bad condition, so I was unable to make out the characters very satisfactorily. It may be that, as Garstang suggests, this species is a form of *A. mentula*. I have found, amongst the specimens agreeing with Hancock's *A. rubicunda* from East Loch Tarbert, some growing amongst *Laminaria* "roots" which agree in external characters with this form. On the other hand, when examining Canon Norman's specimens, I was distinctly reminded by them of Alder's *Ascidia depressa*; and some young specimens labelled "from Guernsey, named by Hancock," are very like young *A. depressa*. These young specimens are also not unlike the specimens of *A. producta*, Hnk., which I have examined. As Ascidiæ continue to grow and change in appearance long after they have commenced to reproduce, and so can be sexually mature without being full grown, it is often very difficult to correlate younger and older forms of the same species; and there must constantly be cases of doubt until the various species have been reared in aquaria and the same individuals have been drawn at various ages.

6. *A. mollis*, Ald. & H.—I have not seen any specimens of this species; but Mr. Garstang\* has found some at the Isle of Wight

\* Journ. Mar. Biol. Assoc. n. s. vol. ii. no. 2, p. 119.

which he considers to belong to Alder and Hancock's species, and of which he has given lately a full description.

7. *A. crassa*, Hnk.—I have examined Canon Norman's type specimens collected at Jersey in 1869. I think this is a good species; and to Hancock's description\* I shall merely add a few notes and some figures from the specimens (see Pl. XXXIV. figs. 7–10).

The branchial and atrial apertures are perfectly sessile and inconspicuous. The test is thick, solid, cartilaginous, and stiff; vessels are present. The mantle is strong and muscular on the right side (Pl. XXXIV. fig. 10) and along the dorsal edge. The branchial sac is notable for the very stout papillæ, which are of two sizes, it is true; but both kinds are so large that they nearly touch at their bases, and practically all the space on the bar between two main papillæ is taken up by the intermediate one (Pl. XXXIV. fig. 9).

The tentacles are numerous and irregular in size. They seem more numerous and densely crowded at the dorsal and ventral edges, and both smaller and fewer at the sides.

The dorsal tubercle is large and of rounded outline; the aperture is anterior, and both horns are turned in, one being long and curved (fig. 8).

8. *A. inornata*, Hnk.—I have not seen any specimens of this species. From the description it seems certainly, as Hancock himself says, rather like Alder's *A. plebeia*; and I do not see that the characters of the branchial papillæ and dorsal lamina establish any real distinction between the two species.

9. *A. producta*, Hnk.—I have examined Canon Norman's type specimens dredged in the Minch in 1866. This species is certainly closely allied to *A. plebeia*, and the smaller (younger) specimens are very like that species; but still I think *A. producta* may be regarded as a distinct species. I have found specimens on stones in East Loch Tarbert below extreme low tide which I refer to this species.

To Hancock's description I would merely add the following remarks (see Pl. XXXV. figs. 1–7):—The test seems to me rather soft and flexible (even in Canon Norman's spirit specimens) and thin, especially on the under surface. The mantle is very thin and is not very muscular, the muscles being, in fact, scarcely visible

\* Ann. & Mag. Nat. Hist. 1870, p. 359.



to the eye even on the right side; the branchial siphon is of extreme length. The prebranchial zone is papillated (Pl. XXXV. fig. 7). The tentacles are very numerous and closely placed. They are alternately large and small, and there are about 60 of each. The dorsal tubercle is large and of ovate form, the aperture is anterior, and the horns are irregular, and may even fork (see figs. 4, 5).

The renal vesicles are exceedingly abundant, and are filled with yellow and brown concretions (Pl. XXXV. fig. 2). They are scattered over the wall of the stomach and intestine, and even encroach upon the mantle.

I do not think that the specimens from Marseilles referred to *A. producta* by Roule \* belong to this species. As one distinction, the dorsal tubercle is of an entirely different type in Roule's species.

10. *A. elongata*, A. & H.—I have seen no specimens of this species. I would suggest—but I am judging from Hancock's short description alone—that the single specimen from Seaham Harbour might be an elongated example of *Ascidicella aspersa* (O. F. Müller).

11. *A. affinis*, A. & H.—I have examined Canon Norman's type specimens, obtained by Dr. Baird in the River Roach, Essex, in 1865, and I am of opinion that they are very like overgrown flabby individuals of *Ascidicella virginea* (O. F. M.). I have seen large specimens of what Alder and Hancock called "*A. sordida*" (which is *A. virginea*) from the Firth of Forth which were like the present form. Pedunculated individuals also, such as some of these *affinis*, are found in *A. virginea* †. On the other hand, the tentacles and dorsal tubercle in Canon Norman's specimens remind me more of *A. aspersa*; but these are very variable organs.

12. *A. Normani*, A. & H.—I have seen what is left of the type specimen, collected by Canon Norman between tide-marks in Strangford Lough in 1869; but unfortunately the specimen had evidently at some former time dried up, and nothing can now be made out from it except the shape and a thin membranous, almost leathery, test.

\* Ann. Mus. Marseilles, t. ii. Mém. 1.

† I described one as variety *pedunculata* in Trans. Roy. Soc. Edinb. vol. xxxii. part i. p. 98.

Hancock's description of this species reminds me strongly of the rather handsome specimens of *Ascidiella aspersa* (*aculeata* form) which are found in some parts of the Clyde district, *e. g.* Lamlash Bay, and of which I give a figure (Pl. XXXIV. fig. 1); there is nothing in the appearance of Canon Norman's specimen to contradict the supposition that "*A. Normani*" may be *A. aspersa* (O. F. M.).

13. *Ciona fascicularis*, Hnk.—I have examined Canon Norman's type specimens, collected by Mr. A. G. More in Kilkieran Bay, Connemara; and there is no doubt that this is a good and well-marked species. I now give some figures (see Pl. XXXIII.) of the external appearance and internal structure, and the following notes to supplement Hancock's description.

The test has distinctly two regions (Pl. XXXIII. figs. 1 & 2)—the enlarged part at the posterior end, which is much firmer and is roughened on the surface, and the remainder, over the greater part of the body and anterior end, which is all very thin and membranous.

The union of individuals into clumps is effected entirely by the interlocking of little papillose outgrowths from the test round the posterior ends and a little way up the sides (Pl. XXXIII. figs. 2 & 3).

The mantle is thin and transparent, but has the strong longitudinal muscle-bands characteristic of the genus. The atrial siphon is completely dorsal in position and at right angles to the branchial. There is a long narrow pedicle connecting the anterior part of the branchial sac with the visceral mass (Pl. XXXIII. fig. 5) so as to divide the body into "thorax" and "abdomen;" but the branchial sac really extends down (though very narrow) to the level of the stomach. The vessels of the branchial sac are all very delicate. Papillæ, and sometimes intermediate papillæ, are present. The stigmata are very wide, and are about 4 in a mesh (Pl. XXXIII. fig. 4).

The tentacles are numerous, slender, about 50 of various sizes placed irregularly, but very closely (Pl. XXXIII. fig. 8).

The dorsal languets are triangular, small, broad, and flattened antero-posteriorly.

The dorsal tubercle is irregularly elliptical in shape, and is elongated transversely, with the aperture anterior and both horns turned in.

The œsophagus is very slender, the stomach pyriform, and the intestine large. Figures 6 and 7 show the curves of the alimentary canal.

The remaining species dealt with by Hancock in this paper are as follows—they are, I believe, all good species:—

<i>Corella larvæformis</i> , Hnk.	=	<i>C. larvæformis</i> , Hnk.
<i>C. ovata</i> , Hnk.	=	<i>C. ovata</i> , Hnk.
<i>Molgula simplex</i> , A. & H.	=	<i>M. simplex</i> , A. & H.
<i>M. inconspicua</i> , A. & H.	=	? a <i>Ctenicella</i> .
<i>M. complanata</i> , A. & H.	=	<i>Ctenicella complanata</i> (A. & H.).
<i>Eugyra globosa</i> , Hnk.	=	<i>E. globosa</i> , Hnk.

It will thus be seen that several of Alder and Hancock's species of *Ascidia* are merely forms of *Ascidia mentula*, and it is a question whether we can recognize them as named varieties.

I have for some years thought it extremely probable that Hancock's *Ascidia rubicunda* and *A. rubrotincta* at least, and possibly other species in addition, were merely varieties of the well-known *A. mentula*, and in my "Revised Classification of the Tunicata,"\* I placed these amongst other species in a list of doubtful forms. Roule †, I believe, was the first to actually place *rubicunda* and *rubrotincta* definitely as synonyms of *mentula*; and Garstang ‡ has lately supported the same conclusion by the examination of some specimens from the Isle of Wight, which agree with "*rubicunda*" in form and with "*mentula*" in colour. I am not prepared to accept Garstang's classification of the varieties of *mentula*. It seems to me (and I am influenced chiefly by having found at Tarbert, Loch Fyne, specimens of all varieties of colour, from pale grey and brown to a gorgeous red, living together near low-water mark and mostly attached by an extensive area of the left side) that the "erect" or "depressed" condition is of more importance than the red or pale coloration; so I would be inclined to suppress "*ruberrima*," "*rubrotincta*," and "*rava*," but retain "*erecta*" and "*depressa*" as varieties §. However, it must be remembered

\* Journ. Linn. Soc., Zool. vol. xiii.

† Ann. Mus. Marseilles, t. ii. Mém. i. 1884.

‡ Journ. Mar. Biol. Assoc. n. s. vol. ii. p. 119.

§ Garstang, *l. c.* p. 128.

that there are really intermediate conditions between all of these named forms.

I have lately picked out three specimens of the typical *A. mentula*, dredged from deep water (30-40 faths.) in Loch Fyne, and three of the form which I regard as Hancock's *A. rubicunda*, collected from stones just below low-water mark in East Loch Tarbert, and have compared them carefully, with the result that although one can tell the dredged from the shore specimens by the lighter grey colour and the slightly more delicate mantle and branchial sac, still there is no structural difference that I can find in any part of the body, and not even a difference in degree that can be expressed in words and relied upon. Consequently I am confirmed in my opinion that these are merely two forms of the same species.

While making this comparison, I have had a useful lesson in regard to the variability in number of the tentacles, and have had my confidence in the published records of their numbers a little shaken by the following observation. Miss J. H. Willmer (whose kind assistance in my laboratory in examining many of these Ascidians I gratefully acknowledge) and I were noting the characters of the above-mentioned six specimens of *A. mentula*, and as they were all large (over five inches in length) and the tentacles seemed clearly visible to the eye, we merely turned these organs over one by one with a needle in counting them, and noted the results in numbers varying from 18 to 24. The appearance of one example, however, made us suspect that more tentacles were really present, and on dissecting out the region and getting it in a good light under the microscope we found that what had been visible before were only the more prominent ones, and that from 70 to 80 tentacles were really present. It was the same with the other specimens, all had over 60, some nearly 100 tentacles. In the published records by Heller, Traustedt, Garstang, myself, and others the numbers vary from 16 to 100, which does seem an extraordinary range; and I am tempted to suspect that I and others in the past may have been deceived by a few of the tentacles being very conspicuous when in reality many others may have been present in addition.

## Family CYNTHIIDÆ.\*

## Subfamily STYELINÆ.

POLYCARPA GLOMERATA (*Alder*). (Pl. XXXV. figs. 8-13.)

This species is probably very abundant on various parts of our coast, but has often, I think, been regarded as *Styela rustica*, or *Stylopsis grossularia*; it is, however, perfectly distinct from both. This is a gregarious form like *Polycarpa aggregata*, and although the tests of neighbouring individuals may fuse so as to form a continuous basal expansion or common test (see Pl. XXXV. fig. 8), still there is no further organic connection between the individuals; there are no common vessels and no buds are produced, consequently no true colony is formed, and the masses, which may be yards in extent, are merely aggregations of individuals adhering together.

There is a huge cavern near Spanish Head, at the south end of the Isle of Man, which can be entered in a boat at low tide, and its walls and part of the roof are covered by a continuous layer of this Ascidian. The individuals are of all sizes from a small pin's head up to nearly an inch across, they are of a rich crimson-red colour, and when touched they emit the usual jets of water forcibly and in all directions. Hence they are known locally as the "red-currant squinters of the sugar-loaf cave."

Good descriptions of this species have been given by Heller †, Traustedt ‡, and by Roule §, so there is no need to go over the characters in detail. The chief points which distinguish it from other British Styelinæ with which it might be confused are:—the agglomerated condition, the brilliant colour, the presence of more than one (usually 3) fold on each side of the branchial sac, and the condition of the reproductive organs—broken up into numerous polycarps each of which is of one sex only.

I find that this is one of those interesting species in which tentacles are present at the base of the atrial as well as of the branchial siphon. They are very numerous but minute (Pl. XXXV. fig. 10). In regard to their possible function, I

\* For the characters of the family and subfamily see Herdman's "Revised Classification of the Tunicata," Journ. Linn. Soc., Zool. vol. xxiii. p. 569.

† Untersuch. u. d. Tunicaten d. Adriat. u. Mittelmeeres, iii. Abth. p. 263 (1877).

‡ Mitth. a. d. Zoolog. Stat. zu Neapel, t. iv.

§ 'Recherches sur les Ascidiées Simples des Côtes de Provence,' Biblioth. de l'École des Hautes Études, t. xxxi. art. no. 8, p. 150 (1885).



communicated a note at the last meeting of the British Association (Edinburgh) somewhat as follows:—

In the interesting paper ('Bulletin Scientifique,' July 1892) by Dr. C. Julin, which forms the first part of his 'Les Ascidiens des Côtes du Boulonnais,' I notice it is stated, on page 30, "L'existence d'une couronne de tentacules circumcloacaux n'a jamais, à ma connaissance du moins, été signalée chez aucune espèce d'ascidien simple ou composé." If it has escaped Julin's attention that I described and figured atrial tentacles in 1882 in a simple ascidian, and in 1886 in a compound one, then I fear it may have escaped notice altogether, perhaps because, along with some other anatomical observations and some theoretical conclusions and suggestions, it is buried in the 'Challenger' reports in a mass of detailed descriptions of new species. At any rate, the existence of atrial tentacles is evidently so little known that the following brief notes upon what I have seen of them may be of interest.

In the simple ascidian *Bathyoncus mirabilis* from the Southern Ocean, at a depth of 1600 fathoms, there are two circlets of minute tentacular processes which project from the inner surface of the cloacal wall close to the atrial aperture. These atrial tentacles are all of the same size, and are placed at about their own length apart (see 'Rep. Tun. Chall. Exp.' part 1, vol. vi., 1882, page 167, and pl. xxiv. fig. 12, *at.t.*).

The ascidiozooids of the compound (?) ascidian, *Goodsiria placenta*, from the Cape of Good Hope, have also atrial tentacles, very much like those of *Bathyoncus mirabilis*, but forming a single series. In the original description (*op. cit.* part 2, vol. xiv. 1886, page 331, and pl. xliii. fig. 10) I wrote as follows: "At the base of the atrial siphon, where the invaginated layer of test ends, there is a slight ridge which bears a series of small tentacles projecting freely into the peribranchial cavity. These atrial tentacles are much smaller than the ordinary or branchial tentacles, and there are only twelve of them. The position of the atrial tentacles in relation to the atrial siphon corresponds exactly to the position of the branchial tentacles at the base of the branchial siphon, but their use at the entrance to the peribranchial cavity is not obvious. It has been observed in some simple ascidians that the current of water which usually flows in at the branchial aperture and out at the atrial is occasionally reversed for a short period, the atrial aperture becoming inhalent. Possibly in the present species this habit may have become so

marked as to have favoured the development of a circle of atrial tentacles, which would act as tactile organs waving in the current of water entering the animal."

During the last few years I have found similar atrial tentacles in at least three new species of the compound (?) ascidian genus *Chorizocormus*, viz., *Ch. sydneyensis*, *Ch. leucophæus*, and *Ch. subfuscus*, all from Australia. In each case they form a single circlet, as in *Goodsiria placenta*, and there are about twenty tentacles. They are briefly referred to in my "Revised Classification of the Tunicata" (1891), at page 636, and will be figured in the forthcoming 'Catalogue of Tunicata in the Australian Museum.' Julin has made the interesting discovery that atrial tentacles are also present in *Styelopsis grossularia*. I have likewise found them in that form, and now I can add *Polycarpa glomerata* to the list of species in which it is known that the organs are present.

I have queried above the genera *Goodsiria* and *Chorizocormus* as being compound ascidians because they belong to the family Polystyelidæ, in regard to which it must be considered still doubtful whether the masses of ascidiozooids are true colonies. But although they may be colonial forms now, there can be no doubt that phylogenetically the Polystyelidæ are closely related to the subfamily Styelinæ of the Cynthiidæ, the subfamily to which *Bathyoncus*, *Polycarpa*, and *Styelopsis* all belong. So we arrive at the interesting conclusion that the five genera in which up to now atrial tentacles have been noticed, although differing widely from one another in appearance, structure, and habitat, are yet phylogenetically rather closely related. I think it not unlikely that atrial tentacles will be found, if looked for, in other members of the groups Styelinæ and Polystyelidæ.

Another point: it is an interesting fact, and may have some significance, that—putting aside *Bathyoncus mirabilis*, in regard to the conditions of life of which we know nothing—all the six other species in which atrial tentacles have as yet been demonstrated form either colonies or aggregations, *i.e.* they have numbers of small individuals or ascidiozooids massed together. It is quite conceivable that, under these crowded conditions, it may be some advantage to the animals to have the power (to return to the suggestion I made in the 'Challenger' Report) of frequently reversing the current of water or of using the atrial for a time as the inhalent aperture—possibly, for example, because of being so placed amongst neighbours that the atrial siphon is able to

draw upon a purer supply of water—and in any such case the advantage of having the entrance to the peribranchial cavity provided with a cirlet of tentacles is obvious.

I find the branchial sac in *Polycarpa glomerata* liable to very considerable individual variation, and in figs. 11, 12, 13 on Plate XXXV. I give the graphic branchial formula\* of three individuals. From these it will be seen that the number of folds may be four on each side, four on one side and three on the other, or three on each side; sometimes there are less than three folds. Usually one fold (or more) on each side is rudimentary, *i. e.* is really no longer a fold, and does not project into the cavity of the sac, and in such cases it is only possible to recognize the position of the missing or reduced fold by the approximation of the internal longitudinal bars (see Pl. XXXV. fig. 11; right side IV., left side I.).

The dorsal tubercle is crescentic, and lies obliquely in a shallow peritubercular area (Pl. XXXV. fig. 9).

POLYCARPA QUADRANGULARIS (*Forbes*). (Pl. XXXVI. figs. 11, 12.)

*Cynthia quadrangularis*, *Forb.*, *British Mollusca*, vol. i. p. 38, pl. D. fig. 1.

This species was described by Forbes in 1853 from specimens dredged by Mr. R. McAndrew and himself from a depth of 30 fathoms in Loch Fyne. So far as I am aware it has not been recorded since, although I find a specimen of it, also from Loch Fyne, amongst the *Cynthiidae* of Canon Norman's collection. I dredged in September 1892 a *Polycarpa* from a depth of 80 fathoms, in Loch Fyne between Tarbert and Ardrishaig, which corresponds so closely with Forbes's figure in the 'British Mollusca' and with his short description that I am convinced that it is the *quadrangularis*, and I am pleased to be able to restore Forbes's species, and give the following sufficient anatomical description of it drawn up from an examination of a specimen hailing from the original locality.

A most marked feature in the external appearance is the pair of long siphons, each of which is quadrangular in section and has the large square aperture on its summit. The apertures fold into an X shape in closing.

\* For the explanation of this brief method of expressing the condition of the folds, bars, and stigmata of the branchial sac, see Herdman, "On individual variation among *Ascidians*," *Proc. Lit. and Phil. Soc. Liverpool*, vol. xxxvi. p. 313 (1882).

The test is tough and leathery, rather thin, wrinkled on the outside, and smooth and glistening on the inside.

The mantle is very thick and muscular, and of a light grey colour.

The branchial sac is large, with four large folds on each side. There are from three to six bars between two folds, and eight or nine on a fold. Meshes are either square or transversely elongated, with four to eight straight stigmata (Pl. XXXVI. fig. 11).

The dorsal lamina is a plain membrane transversely ribbed.

The tentacles are simple, about 30 in number and of different sizes.

The dorsal tubercle is large and somewhat cordate. It is placed in a deep triangular peritubercular area; one horn is much turned in (Pl. XXXVI. fig. 12).

The stomach is longitudinally folded.

The reproductive organs are in the form of numerous scattered polycarps over the inner surface of the mantle.

“*STYELA RUSTICA* (L.)”

There has been much confusion in regard to this species in our seas, and although various authors (from Forbes down to myself) have named British specimens “*Cynthia rustica*,” “*Styela rustica*,” or “*Polycarpa rustica*,” I am now inclined to think that none of these are referable to Linnæus’s *Ascidia rustica*, which is a Northern species probably not inhabiting the British area at all.

I think that what I at least have mistaken in the past for small specimens of *Styela rustica* were really solitary individuals of *Polycarpa glomerata*, which are sometimes found attached to the “roots” of *Laminaria*; and I first suspected that something was wrong when I found that, from the structure of the reproductive organs, my supposed “*rustica*” was really a *Polycarpa*, not a *Styela*, and I pointed this circumstance out in my Report on the L. M. B. C. Tunicata\*. Then I put the matter beyond doubt, so far as my own case was concerned, by dredging large quantities of the true *Styela rustica*, of all sizes from a pea up to 2 inches across, along with the closely allied form *Styela monoceros*, to the north of the North Cape, Norway, in July 1891. The examination of this large series of specimens showed (1) that *rustica* is a *Styela*, and (2) that it is quite distinct from any form I have met with in British seas. Subsequently Canon Norman kindly sent me his specimens of *Styela rustica* from

\* Fauna of Liverpool Bay, vol. i. 1886.

Greenland ('Valorous' Expedition) to examine, and I found that they were the same as my own Norwegian forms.

In regard to the supposed identity of *Styela rustica*, Linn., and *St. monoceros*, Möller, I have the following remarks in my notes made during the examination of my Norwegian collections:—

These two closely allied forms are characteristically northern, and we obtained immense numbers of them on July 11th when dredging near the North Cape at depths of 75 to 150 fathoms. They were of all sizes from little rounded ones like peas up to cylinders 5 cm. in length and 3 cm. in diameter. Many of them were attached together in groups of a dozen or more, and most of the larger ones had small ones growing on their tests. In colour they varied from grey and pale yellow to rich orange and brown. The edges of the siphons were generally of a brilliant scarlet tint. Good coloured figures of both these forms are given by Wagner in his 'Wirbellosen Thiere des Weissen Meeres.' Both Traustedt and Wagner, who have recently written on these forms, consider that they are one species, and that *monoceros* is merely *rustica* with a spine on the test; but after a careful examination of a large number of specimens of both *rustica* and *monoceros*, I am of opinion that there are constant characters in addition to the spine which can be relied upon to distinguish the two forms, and that therefore they may be regarded as distinct species. I have drawn up the following descriptions from the North Cape specimens.

*STYELA RUSTICA* (L.). (Pl. XXXVI. fig. 1.)

*External appearance.* Shape cylindrical to ovate, with the longer axis antero-posterior, not compressed laterally; attached by the wide posterior end. Dorsal and ventral edges nearly straight. Branchial aperture nearly or quite terminal; atrial on the dorsal edge, or slightly on the right side, nearly one third of the way down: both square. Surface slightly roughened, especially at the posterior end. Colour when alive pale yellow to dark red; in spirit dirty yellowish brown.

Length 3-4 centim., breadth 1.5-2 centim.

*Test* not specially thick, but tough and leathery; whitish on section and on the inner surface, where it is glistening—not adhering very firmly to mantle.

*Mantle* muscular and opaque. The external muscle-bands run circularly and the internal longitudinally; they do not form a complete coating. Many endocarps projecting from the



inner surface of the mantle. In some cases a good deal of opaque white pigment present.

*Branchial sac* with four folds on each side. The two dorsalmost folds larger than the others. There are from 6 to 12 bars on a fold and 3 or 4 in the interspace between two folds. The meshes are always elongated transversely, and contain from 6 to 20 long narrow stigmata. The meshes are generally divided by a delicate horizontal membrane. The transverse vessels are of three sizes, regularly arranged.

*Endostyle* large and conspicuous.

*Dorsal lamina* is a plain membrane with transverse ribs but no teeth upon the margin.

*Tentacles* simple, 20 to 30 in number, rather large and stout, alternately larger and smaller, sometimes with a number of very small ones in addition.

*Dorsal tubercle* prominent, large, and simple, with the aperture turned to the left side and the horns slightly turned in.

*The alimentary canal* is large; the stomach is long and is longitudinally folded.

*The gonads* consist of a dorso-ventrally running undulating tube with four or five branches directed anteriorly (Plate XXXVI. fig. 1). The duct runs posteriorly from near the dorsal end of the main tube. There are a number of endocarps scattered around the gonads and between their branches. This condition of the reproductive organs is very different in appearance from that of *Styela monoceros* (see Plate XXXVI. figs. 1 and 2), and by this character the two species can be distinguished at a glance when the mantle has been cut open and its inner surface exposed.

#### STYELA MONOCEROS (*Möller*). (Pl. XXXVI. fig. 2.)

*External appearance.* Elongate elliptical, not compressed laterally, attached by the base and a little way up the ventral side. The anterior end is marked by a curious spine-like projection composed of a solid outgrowth of test; it is situated midway between the branchial and atrial apertures. The branchial aperture is rather prominent and conspicuous, almost terminal, but inclining a little more towards the ventral edge; the atrial is smaller and less conspicuous, placed a little way down the dorsal side. The surface is considerably creased and roughened, in some specimens a good deal covered with zoophytes, shells, and other foreign matter. Colour dirty greyish yellow.

*Test* thin, but tough and leathery, whitish on section; inner surface smooth and shining, adhering rather firmly to the mantle.

*Mantle* very muscular, thick, and opaque. The external muscle-bands run circularly and the internal ones longitudinally, forming a complete coating. Numerous endocarps project from the inner surface of the mantle.

*Branchial sac* with four folds on each side, the two dorsalmost distinctly larger than the rest. On each fold there are from 12 to 14 bars, and from 10 to 12 in the interspaces. The meshes are small and nearly square, containing from 3 to 10 narrow stigmata, and most frequently divided by a narrow horizontal membrane. The transverse vessels are of three sizes.

*The dorsal lamina* is a plain membrane with transverse ribs.

*The tentacles* simple, about 16, some very large, but varying much in size and length.

*Dorsal tubercle* prominent, almost circular in outline, the horns slightly curled inwards, opening occasionally anteriorly, but more often to the left side.

*Endostyle* very broad, and considerably convoluted for a portion of its length, sometimes for the whole distance.

*The gonads* consist of one or two convoluted tubes on each side, with two or three very short branches, if any, and with the duct at the anterior extremity of the main tube and directed anteriorly (see Pl. XXXVI. fig. 2).

#### Subfamily CYNTHIINÆ.

FORBESELLA TESSELLATA (*Forbes*). (Pl. XXXVI. figs. 3-10.)

A number of specimens dredged lately off the west of the Isle of Man, about 9 miles off Contrary Head, depth 46 fathoms, have enabled me to make a careful re-examination of this species. The specimens are mostly attached to dead shells of *Pecten maximus*, and they present a very great range of variation in shape, colour, texture, and general appearance—so much so that at first I was under the impression that I had before me two or three species; and now I can see that forms corresponding to Forbes's two species *Cynthia tessellata* and *C. limacina* are represented in the series, and that it would be possible to pick out and describe even more divergent specimens (see Pl. XXXVI. figs. 3-7).

In regard to shape, the typical form is like half a small walnut, but some are hemispherical while others are nearly quite flat, the

antero-posterior length (from the branchial aperture to the area of attachment) being very slight indeed compared with the extent in other directions. Around the edge of the area of attachment there is a thin margin or expansion, which is in some cases narrow and in others very wide (see figs. 3 & 5). The surface may be rough and corrugated or quite even; and I could not see that this difference was the result of the state of contraction of the animal, as I had about fifty specimens alive for a couple of days in my tanks at the Port Erin Biological Station, and the corrugated ones did not seem to fill out, although the branchial and atrial apertures were open. Even the characteristic polygonal scale-like markings on the surface of the test are much more distinct in some individuals than in others, and may be emphasized by touches of rose-red upon each scale so as to form a series of lines of spots (see fig. 7).

The colour of the living animal is generally of a reddish-purple tint, but it may be rose-red or grey with rosy marks, or it may be light yellow to yellowish brown, or finally of a dark purple. The specimens are, on the average, about 1.5 cm. in length.

The test is tough, although not thick except at the margins of the base. It is white on section and glistening on the inner surface, in places tinged with violet-red, which is specially marked at the branchial and atrial apertures.

The mantle is fairly muscular, and has a serrated projecting fold or partial diaphragm at the base of the atrial siphon, just in the position occupied by the atrial tentacles in *Polycarpa glomerata* and other forms.

The branchial sac has four well-marked folds on each side. The internal longitudinal bars are narrow and ribbon-like. There may be as many as 11 between two adjacent folds, or as few as 4, more usually there are 7 to 9. The meshes are square and contain about 4 large regular stigmata each (Pl. XXXVI. fig. 8).

The dorsal tubercle is nearly circular in outline. The horns are simply turned towards one another and are not bent (Pl. XXXVI. fig. 9).

The dorsal languets are very long and slender (Pl. XXXVI. fig. 9), and are more numerous than the transverse vessels; there are from 40 to 60 of them.

The tentacles are compound and of two very different sizes; there are about twenty of each. The stems of the larger ones are much inflated (see Pl. XXXVI. fig. 9).

Obs.—The remaining Cynthiidae and the Molgulidae, as well as a few Ascidiidae, must be left over for a further instalment of these “Notes.” Perhaps it ought to be stated that the coloured drawings of the species, which were exhibited when this paper was read, are reserved for my detailed monograph of the entire group which is now in progress.

Note.—Since this paper was in type I have received, thanks to the courtesy of the authors, a copy of the beautiful Monograph by MM. Lacaze-Duthiers and Yves Delage, entitled “Faune de Cynthiades de Roscoff” (Mém. Acad. Sci. Inst. France, t. xlv. no. 1), in which, amongst other forms, the following Cynthiidae dealt with in the present paper are discussed, viz. *Forbesella tessellata*, *Styela rustica*, and *Polycarpa glomerata*. I must defer till some future opportunity a detailed examination of their results, and will now merely express my impression that what they describe as *rustica* and refer to the genus *Polycarpa* is not the northern and true *Styela rustica* (cf. *antea*, p. 448).

EXPLANATION OF THE PLATES.

PLATE XXXIII.

Fig. 1. Group of five individuals of *Ciona fascicularis*, Hnk.

2. A single solitary individual.
3. Base of clump of two individuals, showing the interlocking villosities.
4. Part of the branchial sac from the inside.
5. An individual removed from the test, natural size.
6. The alimentary canal, showing the posterior prolongation of the branchial sac.
7. The alimentary canal, showing œsophagus and stomach.
8. The tentacles, dorsal tubercle, and dorsal languets.

(All from Canon Norman's type specimens.)

PLATE XXXIV.

Fig. 1. Large specimen of *Asciidiella aspersa*, from Lamlash Bay (? Hancock's *Ascidia Norman*).

2. Abnormal specimen of *Asciidiella virginea* (= *Ascidia sordida*, A. & H.), from Firth of Forth.
3. Outline (reduced in size) of three individuals of *Ascidia affinis*, Hnk., sticking on small oyster-shell (from Canon Norman's types).
4. Individual of *Ascidia affinis*, with test removed, from left side to show enormous intestine.
5. Dorsal tubercle and tentacles of *Ascidia affinis*.
6. Dorsal tubercle from another individual.
7. Outline of specimen of *Ascidia crassa*, Hnk.
8. Dorsal tubercle of *Ascidia crassa*.
9. Part of branchial sac of same.
10. Individual of *Ascidia crassa* with test removed.

(Figs. 3 to 10 are from Canon Norman's type specimens.)

## PLATE XXXV.

(Figs. 1 to 6 are from Canon Norman's type specimens.)

- Fig. 1. *Ascidia producta*, Hnk., natural size, from right side.  
 2. The same species with the test removed, from left side, showing alimentary and reproductive organs, and renal vesicles scattered over the stomach.  
 3. The same, from the right side, showing the very faint muscles.  
 4. Tentacles and dorsal tubercle of same species.  
 5. Dorsal tubercle of another specimen of same species.  
 6. Part of branchial sac of same.  
 7. Tentacles and dorsal tubercle, &c., of a specimen of *Ascidia producta* from Tarbert, Loch Fyne (W. A. H.).  
 8. Mass of *Polycarpa glomerata*, from Port Erin.  
 9. Dorsal tubercle, &c., of *P. glomerata*.  
 10. Atrial tentacles of *P. glomerata*.  
 Figs. 11, 12, 13. Graphic branchial formulæ of 3 individuals of *P. glomerata*, showing the condition of the branchial folds, &c.

## PLATE XXXVI.

- Fig. 1. Viscera of *Styela rustica*.  
 Fig. 2. Viscera of *Styela monoceros*.  
 Figs. 3, 4, 5, 6, & 7 show different specimens of *Forbesella tessellata*, and give some idea of the range in variation of shape; natural size.  
 Fig. 8. Part of the branchial sac of *Forbesella tessellata*.  
 9. Tentacles, dorsal tubercle, and languets of *Forbesella tessellata*.  
 10. Interior of atrial siphon of same species, showing partial diaphragm.  
 11. Part of branchial sac of *Polycarpa quadrangularis*, Forbes.  
 12. Dorsal tubercle of *P. quadrangularis*.

Contributions to our Knowledge of the Arthropod Fauna of the West Indies.—Part II. Chilopoda. By R. I. Pockock, of the Natural History Museum. (Communicated by W. PERCY SLADEN, Sec. Linn. Soc.)

[Read 16th March, 1893.]

A GLANCE at the following list of the species of Chilopoda or Centipedes here enumerated as West Indian will show that the members of this group are neither numerous nor unknown. Only 5 species have been described as new, and 4 of these—namely, the two species of Geophilidæ, the *Cryptops*, and the *Newportia*—are of such small size, that they are not likely to come to hand again without special search. It is consequently probable that we shall have to wait many years before we discover whether or not they are peculiar to the Lesser Antilles.





Fig. 3.

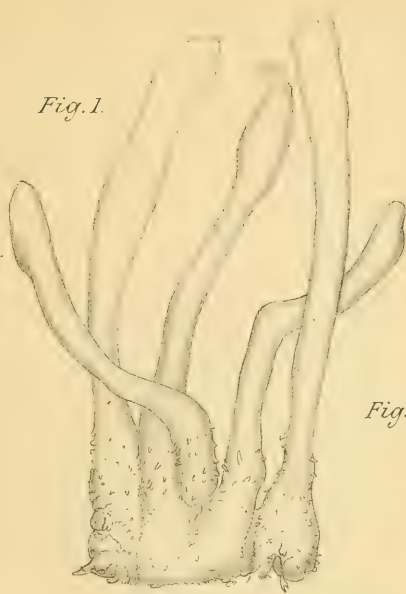


Fig. 1.



Fig. 2.

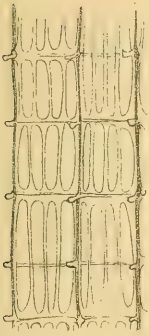


Fig. 4.

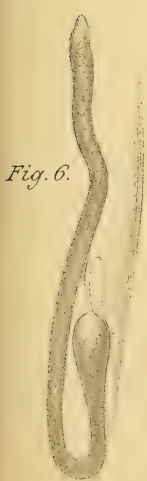
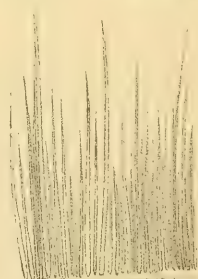


Fig. 6.



Fig. 7.

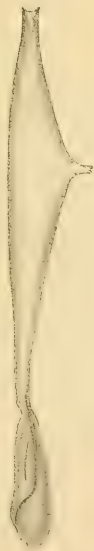


Fig. 5.

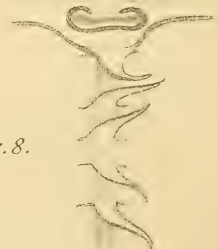


Fig. 8.

W A. Herdman del.

F. Huth, Lith' Edin'

CIONA FASCICULARIS, Hancock.  
(from Dr Norman's types.)

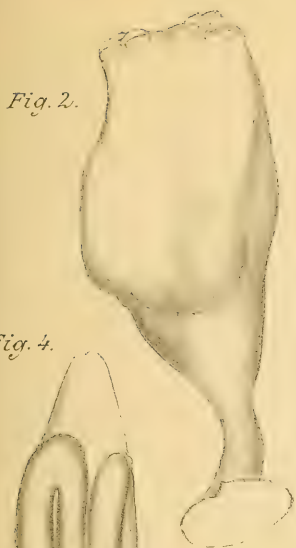


Fig. 1.



Fig. 4.



Fig. 3.

Fig. 5.

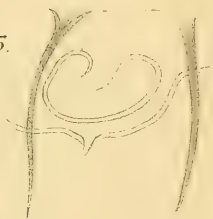


Fig. 6.



Fig. 10.



Fig. 9.

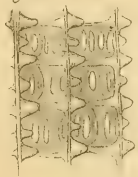
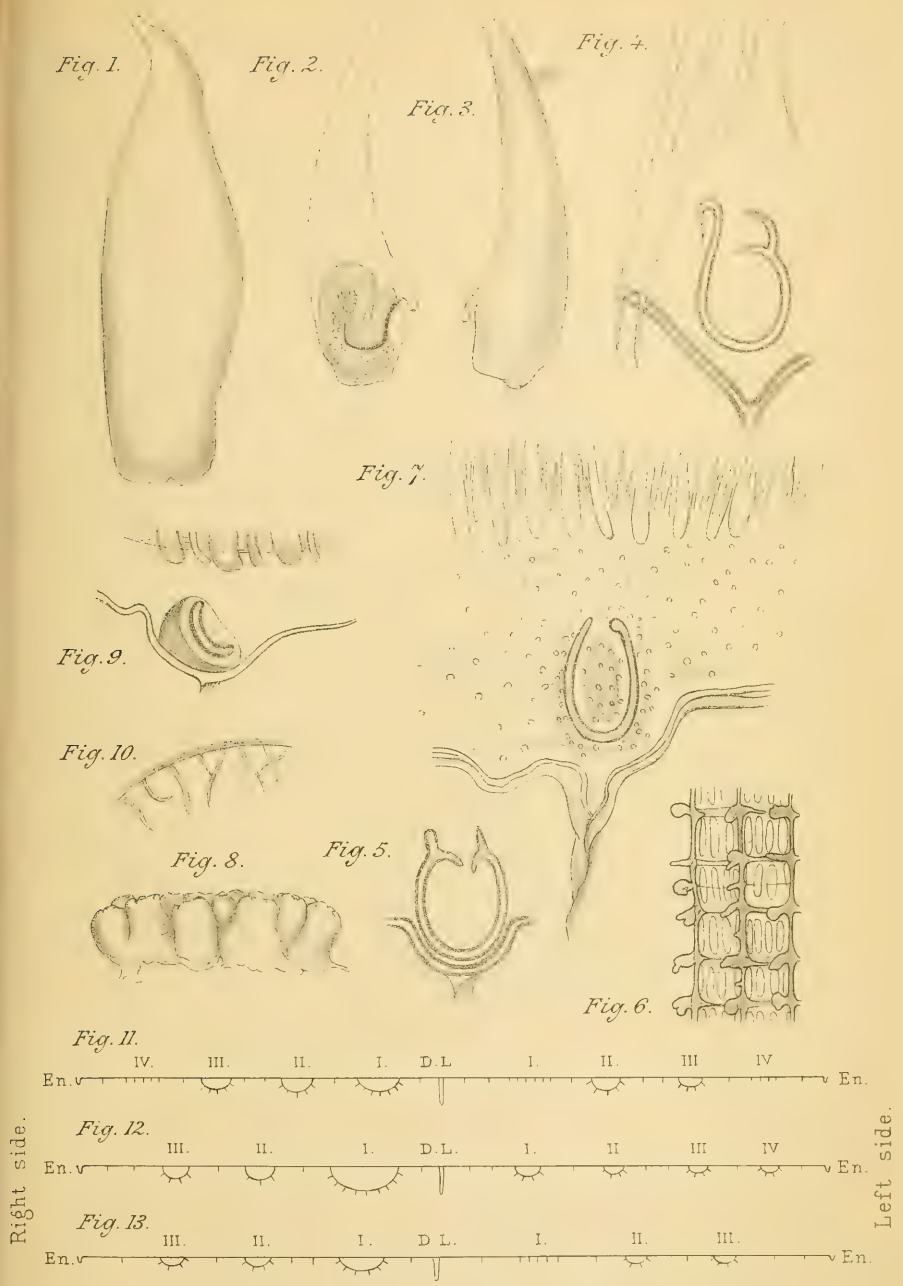


Fig. 8.



Fig. 7.





W.A. Herdman del.

F. Huth, Lith. Edin.

Fig<sup>s</sup> 1-7, ASCIDIA PRODUCTA, Hancock.  
 Fig<sup>s</sup> 8-13, POLYCARPA GLOMERATA, Alder.

Fig. 1.



Fig. 9.

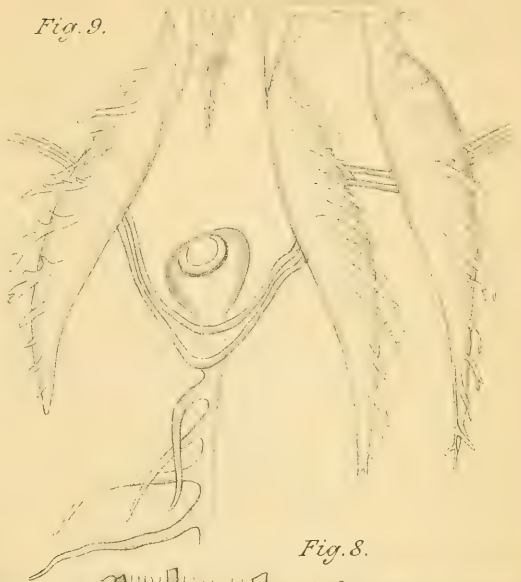


Fig. 2.



Fig. 10.

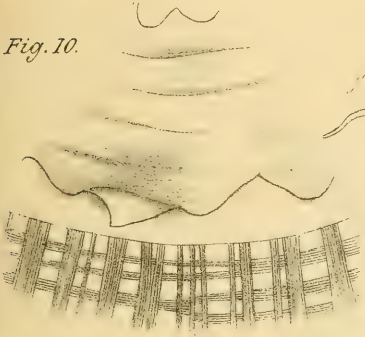


Fig. 8.

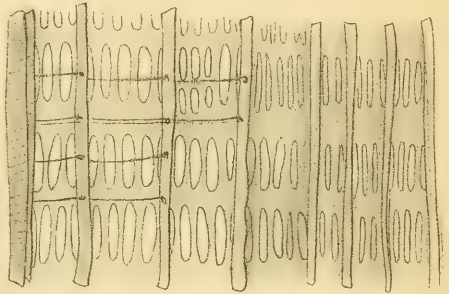


Fig. 3.



Fig. 4.



Fig. 5.

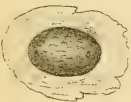


Fig. 6.



Fig. 7.



Fig. 11.

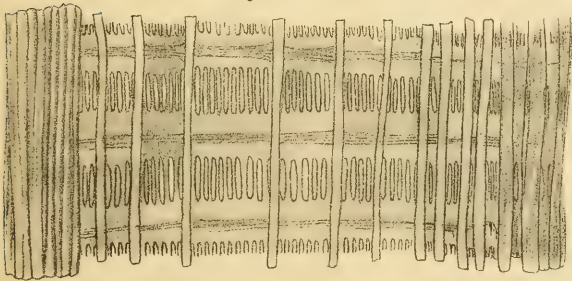


Fig. 12.



W. A. Herdman del.

F. Huth, Lith. Edin.

Fig. 1, *STYELA RUSTICA*. Fig. 2, *STYELA MONOCEROS*.  
Fig. 3-10, *FORBESELLA TESSELLATA*. Fig. 11, 12, *POLYCARPA QUADRANGULARIS*.